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Compensating Victims of Occupational Diseases: Can We Structure an Effective Policy?

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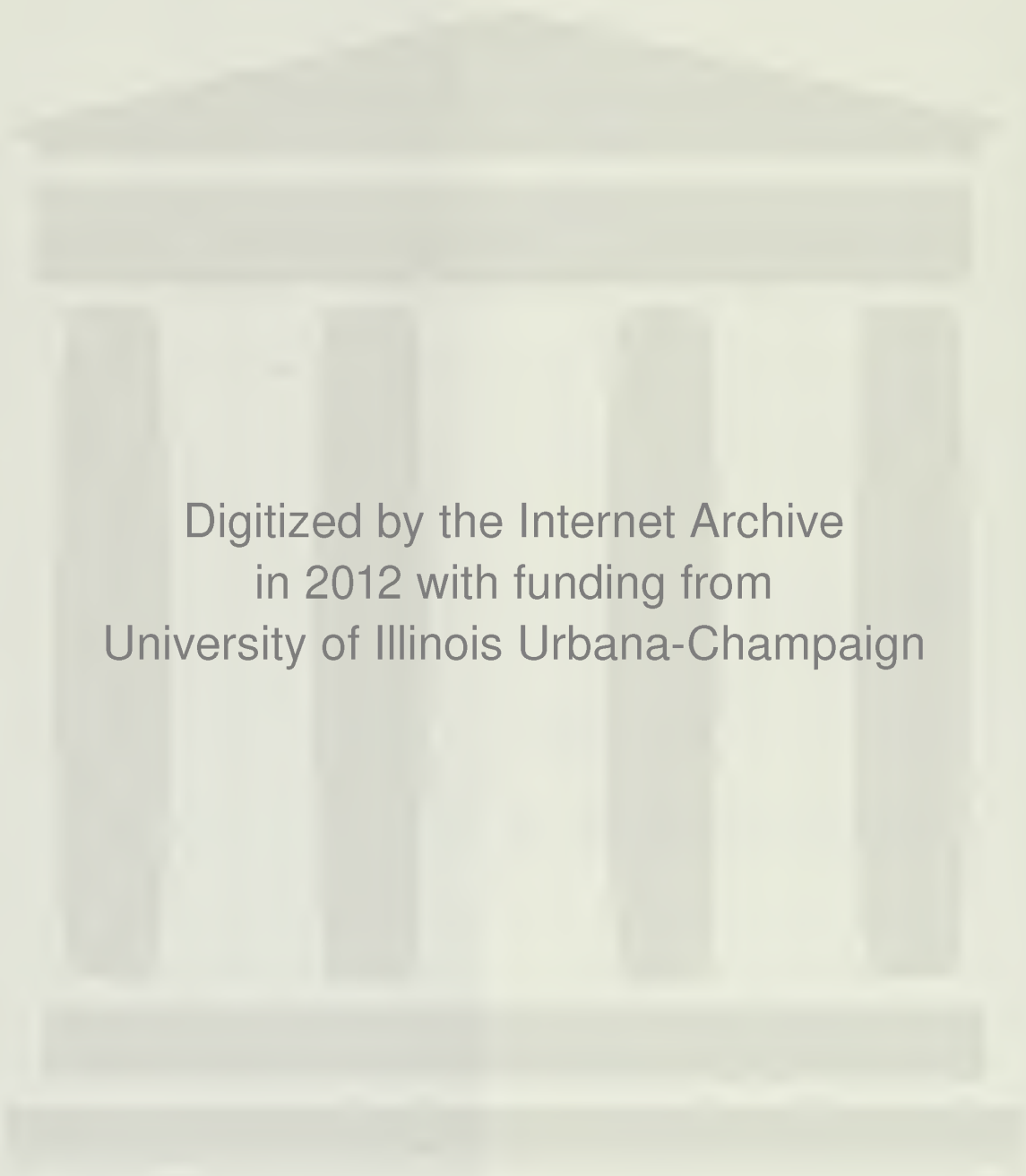

Abstract

Compensating victims of occupational diseases poses many problems such as determining the source(s) of exposure, apportioning financial responsibility if there are multiple sources, creating incentives to discover and disclose information as well as incentives to provide a safe workplace, and providing an equitable level of compensation to disease victims. A compensation mechanism must work well within the bounds placed upon it by imperfect information and limited resources. This paper considers the design of such a mechanism. We pay particular attention to satisfying both ex ante and ex post criteria of efficiency. Compensation systems that are ex-ante efficient--thus providing proper incentives for all economic agents to take efficient actions--cannot be deemed totally satisfactory when the system has the possibility of bankrupting itself or when ex post compensations are not correlated with damages incurred. Thus, ex post considerations must also be examined. We define these ex post criteria and show how much of the existing literature has not attempted to address these issues.

I. Introduction

Workers afflicted with occupational injury or disease are compensated for their losses in a variety of ways. The mechanism that is most often considered is Workers Compensation insurance which, under suitable conditions, provides compensation for such losses without regard to fault on the part of the employer. Workers may also be compensated through the existence of wage differentials related to the anticipated losses or to the portion of those losses not properly compensated from other sources. In addition, victims of occupational injury or disease may obtain compensation through the tort system if the cause of injury or disease is a product whose producer has failed to provide it in a safe form or with suitable warnings regarding the dangers involved in its use. Other sources of compensation include private disability insurance, private health and accident insurance, and payments under public programs such as Social Security. This paper discusses the problems associated with structuring a reasonable system of compensation for occupational disease in a context in which various sources of compensation exist.[1]

Compensating the victims of occupational diseases poses several problems in addition to those ordinarily associated with compensating the victims of other workplace accidents. Quite often, the number of diseased workers affected is large, the source of exposure to the

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[1] By occupational disease we mean impairment that does not follow obviously and immediately from exposure to a work-related source. When the impairment follows immediately and obviously it will be called an "accident" or "injury."

disease is not clear and the manifestation and/or discovery of the disease is delayed over time. These factors add complexities to the already complex issues surrounding questions of financial responsibility. The recent publicity given to asbestos-related diseases and the bankruptcy filing of Manville Corp. have served to heighten public awareness of some of these problems. Any system of compensation for victims of these diseases must look toward the joint goals of fair and efficient compensation on the one hand, and providing the incentives necessary to maintain a safe work environment on the other. This paper strives toward establishing such a system.

Any set of rules regarding the responsibility for untoward events will affect the way in which agents choose to act in pursuit of their self-interest. If the rules impose all the costs of untoward events on the users of a product, the manufacturer will have only secondary reasons for making a safe product whereas the user will have strong incentives to select safe products and use them sparingly. At the other extreme, if the manufacturer is deemed responsible for all untoward effects, the user will have no incentive to select safe products or to use them safely whereas the manufacturer will have direct incentives to produce safe products. The existence of financing mechanisms such as insurance and even the way in which such financing mechanisms are priced also have effects on who bears the cost of unsafe products and, ultimately, on what level of safety will be selected.

The selection of safety levels in the workplace is also influenced by the rules that are developed to allocate financial responsibility.

If workers were to be required to bear all the consequences of untoward events, we might expect to find that workers select their opportunities for employment with great care and exact higher wages from employers that have records of high frequencies of severe accidents. Employers, for their part, would be acting rationally if they devoted to safety only as much as is required to offset the effect of lower labor supply. If, on the other hand, employers are responsible for all the financial burden of untoward events, they would allocate to safety as much as is required to just offset the declining cost of accidents; workers should then be indifferent among employers that use the same methods of production.

In this paper we attempt to provide a framework for evaluating the effect of rules on the allocation of financial responsibility on safety levels in the workplace, paying particular attention to the problems associated with occupational disease.

II. Some Limitations of Previous Studies

Many studies have been published on the effects of rules for the allocation of financial responsibility on the way in which safety levels are chosen.[2] For the most part these studies have related either to issues of product safety, which is covered under the tort system, or of workplace injuries resulting from sudden and clearly identifiable events in the workplace, which are usually covered by Workers' Compensation under a system which is basically no-fault.

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[2] See, for example, Landes and Posner (1984), Danzon (1984) and Oi (1973).

Many issues related to occupational disease, however, are quite different from those related to occupational injuries. Two major factors account for this difference: (1) Long-term exposure is often involved in the development of the disease and (2) exposures leading to the disease might be encountered both in the workplace and elsewhere. Moreover, these two factors may interact.

As an example, consider the relationship between noise and hearing impairment.[3] The extent of damage to hearing increases as the level of sound increases and as the duration of the exposure increases. Intermittent exposure is less damaging than constant exposure, and periods of relative silence tend to reduce or limit the amount of damage. Instances of impaired hearing from exposure to noise will not occur immediately after exposure. Typically it may taken 10 or 20 years for impairment to be functionally significant. This lapse of time by itself distinguishes this example from the types of injuries discussed in the literature. In addition, there is the problem that the worker may expose herself to high sound levels by frequenting disco bars or engaging in motorcycle races. Thus the relative effects of the workplace exposure and the voluntary exposure become an issue. Finally, there is an interaction in that high sound levels on the job will cause temporary hearing loss and contribute to the need for playing music or conducting conversations at a level of sound higher than would otherwise be used. The paradigms used in the literature adapt poorly to such circumstances. Other occupational-disease

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[3] See Burns and Robinson (1970).

exposures, such as asbestos, cotton dust, coal dust, and stress differ in detail from the example presented above, but retain many of the features that distinguish it from the models of occupational injury.

Effects that occur long after exposure have been discussed in a number of papers, both in the context of product liability and in that of workplace safety. Most of the discussion has centered on events that have a brief duration, such as a sudden release of radioactivity or of a carcinogenic substance. Though the consequences of these events may not become apparent for a long time, the timing of the event and the parties at play are both clearly identifiable. When the exposure itself is protracted, however, it is not nearly as easy to identify the parties at issue, especially if the business line which causes the exposure is one in which the turnover of labor is high. A well-known example comes from the mining of radioactive ores in the post-war period in the United States. The average tenure of a miner in a given uranium mine is said to have been about four years whereas the average lag from exposure to radioactivity to overt cancer is around 25 years. Thus, determining the relative responsibility of the various employers is no trivial matter. Similar problems are common in exposure to asbestos. Many of these problems are discussed by Danzon (1984), Epstein (1984) and Viscusi (1984).

These problems stem from a variety of sources. A key one is the fact that when exposure is cumulative the effects are not necessarily additive. If we expose a worker to asbestos this year and you expose a worker to asbestos next year, the health consequences will not be the same if they happen to be the same worker as they would be if they

had been different workers. The issue of responsibility is greatly complicated by non-additivity. Basically we should recognize that, under these conditions, we are dealing with externalities and that these effects cannot be addressed from a perspective of property rights which covers only private goods. The externalities we are dealing with are, in essence, public harms. It is not our intent in this paper to create a new system of allocation based on the economics of public goods; areas in which nonadditivity is important will, however, be duly noted. As a rule, non-additivity creates a need for identifying the prior exposures of individual workers and using that information in subsequent decisions. Though there may be strong economic incentives to promote rational decision making (given the information), there may also be rational objectives that create barriers to the flow of information. An individual who is at high risk of developing lung cancer or emphysema because of personal habits (such as smoking) or individual characteristics (such as genetic anti-trypsin deficiency) and has been exposed to asbestos in one setting may well object to being barred from working in other environments that create a health hazard which is, incrementally, very small in the specific instance but provides the expectation of substantial compensation if the disease were to become manifest.

Another limitation of the existing literature on the subject of safety incentives is the artificial separation of tort systems and no-fault systems. While under some conditions it may be worthwhile to assume that the employer is only an employer, in the case of some of the gradual exposures that result in injury related to employment

there is also the possibility that injury will result from the employer's role as a producer. The courts already recognize this "dual-capacity theory" as one way around the Workers' Compensation laws. Asbestos is a typical example of the coupling between the employer in the role of employer and the employer as a producer. A company such as Manville Corp. would have derived no benefit from exposing workers to asbestos dust in the course of manufacturing asbestos products if it were not for the fact that asbestos products were used by others. If the use of the product results in potential exposure of users, the company may bear financial responsibility for untoward health effects in both the workplace and the market place. The financial responsibility for these two types of effect is, under current practice, subject to different rules. It would be unrealistic to assume that the company performs separate analyses for setting safety policy in these two segments and ignores the interactions. It is more reasonable to assume that the company will recognize that some policies may make sense from one perspective but not from the other. Thus, if information comes to light on the potential harm of a particular kind of exposure the company might have every incentive to disclose the fact and take remedial action to minimize the effect on current employees and future users, but might find itself bankrupt if the tort rules impose on it the financial responsibility under product liability for all past users of the product. Ignoring the possibility of such interactions may result in grossly misleading conclusions.

Another area which is affected by the assumed relation between exposure and effect is the ability to collect information and draw conclusions. In the case of sudden toxic releases of short duration,

it is conceivable to keep track of the exposed population and measure the health effects, although there may be a big gap between conceiving such an activity carrying it out as the recent Union Carbide mishap in Bhopal points out. In the case of gradual exposure, this activity can hardly be entertained seriously unless we anticipate ex ante that there will be a gradual exposure, that the exposure will be harmful, and that we know all alternate sources of simultaneous exposures. A meaningful analysis of the data would also require detailed knowledge of the alternate sources of exposure among the population under study and of models that relate the timing and severity of exposure to the resultant health effects. As an example of the problems that are likely to be encountered, consider that most of the studies of the health effects of caffeine are based on information on consumption of coffee and tea and ignore two major sources of caffeine consumption in the U.S.: cola beverages and analgesics. Thus, the existence of any reliable information is likely to be a problem. It is, therefore, a mistake to assume that all effects are known accurately in trying to assess the relative value of various rules in providing incentives to behave in ways that we may view as socially acceptable.

Finally, it is a mistake to assume, as much of the existing literature has done, that we can define unambiguously what constitutes socially optimal behavior. The structure of the problem is so complex that the existence of a "best solution" should be proven rather than assumed, and if there is no best solution, as turns out to be the case, alternate methods for evaluating rules must be adopted.

III. Issues in Financing Reparations

Recently, 34 asbestos products and 16 insurance companies signed the so-called Wellington Agreement. This agreement, named after its principal designer, Yale Law School Dean Harry Wellington, establishes a mechanism for handling asbestos-related damage claims. Only one month after this signing, Manville Corporation, the most well-known litigant in the asbestos arena and a company which was not a signer of the Wellington Agreement, announced its establishment of a similar method for handling asbestos-related claims. Both of these events underscore the unsatisfactory workings of extant mechanisms in dealing with asbestos-related damages. This dissatisfaction stems from two sources. One is the enormous financial burden that can build up rapidly and unexpectedly in tort cases involving occupational disease. For example, prior to the setting-up of these claims mechanisms, the estimated value of claims against asbestos manufacturers had exceeded the sum of their financial resources plus the financial resources of their insurers by more than one billion dollars.[4] The second source of dissatisfaction is the high transaction cost involved in settling these claims. Of the one billion dollars spent on asbestos-related claims from the early 1970's to the end of 1982, some $560 million had gone to defending the cases, $40 million to litigation among organizations regarding insurance coverage and liability, $164 million to pay

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[4] See MacAvoy, Karr and Wilson (1982), who estimate the total net worth of asbestos producers and insurers involved in the litigation at $37.1 billion while their estimate of total claims liability (in 1982) is $38.2 billion.

for plaintiffs' legal fees, and only $236 million to pay net compensation to the plaintiffs.[5]

Potential Bankruptcy

If existing claims exhaust the ability of the system, either through limits of insurer liability or through protection of manufacturers by bankruptcy laws, there will be no recourse available for possible later claimants. Exhaustion of the system may create inequities that favor those who can settle claims early, while excluding equally deserving claims that arise too late to make a claim against the assets of the producers and insurers. The problem of insolvency appears minor in the case of Workers' Compensation because most states require the interposition of third-party insurers and make provision for state guarantee funds. The validity of such guarantees, however, is largely predicated on the notion that present methods of dealing with occupational disease will continue to be acceptable. If current limitations on coverage were lifted by a court decision and the corresponding liabilities were of the order of magnitude of those encountered in asbestos-related cases, real doubt might arise regarding the ability and willingness of state funds to cover the resulting financial obligations.

The most famous particular example is that of Manville Corporation (formerly Johns-Manville) which surprised the financial and legal communities on August 26, 1982 with its Chapter 11 filing. It was the

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[5] See Kakalik, et al. (1983).

first time that a financially healthy company had turned to the U.S. Bankruptcy Code to protect itself from future economic ruin. Several other asbestos manufacturers have also recently filed under Chapter 11. Manville was profitable at the time of its filing and has gotten even more profitable since. In the first half of 1985, Manville's net earnings were $32.6 million on revenues of $993.9 million. However, the company also faces some $112 billion in liability claims including some 20,000 claims for asbestos-related diseases worth more than $29 billion; although, some people contend that Manville may have exaggerated its future liabilities to help its Chapter 11 cause.

While the above statistics for Manville Corp. give some idea of the financial impact involved, we note that Manville is only one of many defendants involved in asbestos-related disease claims. We also note that there exist many other causes of occupational disease in addition to the cause of exposure to asbestos. Some of these causes have received a great deal of attention in attempting solutions, such as black lung disease, which precipitated the Black Lung Benefits Act of 1969. This Act has been amended frequently since that time. Other causes, such as exposure to Agent Orange, which has received much recent publicity, have not had special systems fully established for compensating victims. And indeed many other occupational diseases abound. The Bureau of Labor Statistics documents approximately 162,000 occupational illnesses each year, a figure which likely understates the true number.[6]

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[6] See Viscusi (1984), p. 54.

Finally, we point out that although this paper is directed primarily towards occupational safety, it also has general implications for the use of hazardous products in the workplace in general. Workers frequently file suits against the producers of such hazardous products as a means of circumventing the limited recompensing of Workers' Compensation insurance. This is possible even when the manufacturer of the hazardous product and the employer are one in the same through the so-called "dual capacity" theory.[7]

Transaction Costs

Manville Corporation had already paid close to $50 million in legal fees and court costs from the time its Chapter 11 proceedings began through the beginning of 1986. However, these costs were paid in part to set up its present system and a chief goal of its present system is to reduce costs of future litigation. This is understandable when one considers the high transactions costs of compensating victims through the current system. In products liability insurance, for example, only about 37.5 cents out of every premium dollar goes to compensate victims. The remainder goes to insurer operating costs and to legal costs.[8] Furthermore, even these costs would underestimate the costs associated with paying out claims dollars, as they do not

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[7] The dual capacity theory allows for the injured party to sue the employer in the latter's capacity as producer of the hazardous product. Otherwise, the employer would be protected against a suit via Workers' Compensation laws. See, for example, Williams and Heins (1985).

[8] See Viscusi (1984), p. 69; see also Tobias (1982), p. 211.

include costs such as lost wages and transportation costs for court appearances.

Another cost is the cost of unfiled claims. If the compensation system is somewhat complex, many individuals might feel intimidated by it. Perhaps they would experience some disutility in seeking recompense for an occupational injury. For example, someone might prefer not to testify in court; or they might not appreciate having their background history researched; or they may wish to simply forget about some untoward event rather than be forced to recall the details of their mishap over and over again. While such costs do not show up on a company's balance sheet, they are nonetheless costs imposed on society by the frictions within the compensation-seeking mechanisms; and as such these costs could perhaps be viewed as a type of social transaction costs.

IV. The Nature of Exposures

Multiple Causes and Sources

If our compensation mechanism for occupational diseases and injuries is based in part on the contribution of workplace conditions to the resulting disease or injury, a problem arises as to what that contribution might be. Much attention has focused on the problem of determining who ought to pay for occupational disease cases. One of the major problems is determining the source of exposure. If we were dealing with a well-defined accident with immediately recognizable untoward consequences, we could focus on the questions of negligence (if a negligence tort standard is extant), work relatedness (if a

Workers' Compensation hearing is involved) and/or the degree of compensation. However, the cause of many occupational diseases is harder to determine as no accident per se may have occurred. Instead the exposure might have taken place over a period of time and might have been from one of a number of different possible sources. As such, it underscores the distinction between the terms "accident" and "occurrence" in the language of insurance policies.[9]

The usual problems involved with showing negligence apply if we seek recourse under a negligence torts standard. Even with a strict liability theory of torts, many problems are encountered in occupational disease cases. For example, there might be numerous potential causes of a disease, and indeed it is highly likely that several of these potential causes were jointly responsible for the disease. It may be impossible, however, to determine which of the potential causes was actually responsible or to what degree each cause is actually responsible. In this regard, we might be faced with an reducible uncertainty.

To complicate matters, we might have not only multiple causes of the onset of the disease, but also may have multiple sources for each cause, multiple employers as potential contributors to the onset of the disease, and perhaps the lifestyle of the individual as another

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[9] The concept of an "occurrence" is broader than that of an "accident." The key distinction is that the latter is viewed as sudden and unintentional. Three Mile Island, for example, was an accident. However, a worker at another nuclear power plant might feel that she was exposed to too much radiation over her 10 year employment tenure. Such exposure would be an "occurrence," although no "accident" had occurred.

contributing factor. For example, the smoking of cigarettes is known to increase the risk of asbestos-related diseases.[10] Some diseases, such as cancer, and coronary disease could obviously come from a number of possible on- and off-the-job exposures. There also exists the possibility that the disease was caused by exposure to several different substances and/or conditions, any one of which would have been harmless in isolation.[11] How should we apportion financial responsibility in a situation such as this?

The complexity of the problem is compounded by the observation that multiple causes often do not provide additive contributions. In many instances the risk from exposure to multiple causes is close to multiplicative. Smoking, for example, increases the risk of lung cancer by a factor of 10 in people who are not exposed to asbestos and by the same factor in people exposed to a given level of asbsestos.[12] Asbestos itself increases the risk of lung cancer by the same factor in people of various ages. This characteristic implies that the marginal contribution of a given exposure depends on all other exposures and cannot be easily isolated.

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[10] See, for example, Beclake (1976).

[11] For example, several deaths are caused each year by someone using chlorine bleach to help clean their toilet. When mixed with commercial toilet bowl cleaners, the bleach causes a toxic vapor to form.

[12] See, for example, I. J. Selikoff, "Disability Compensation for Asbestos-Associated Disease in the United States," Report to the U.S. Dept. of Labor, Environmental Sciences Laboratory, Mount Sinai School of Medicine, New York, NY, 1981.

Given these elements, the way in which financial responsibility should be apportioned is not clear. The apportionment rules will have an important bearing on the deterrent value of the system and on the resulting allocation of resources.

Time Delays

The problems associated with determining the cause of a disease are exacerbated, in the case of occupational diseases, by long latency periods and the intertemporal nature of the exposures. Also, new problems are created by these time lapses. For example, consider a disease that is not manifested, or at least not diagnosed, until 20 years after exposure at a former workplace. The employer responsible for the exposure may have been out of existence for quite some time. Its records might no longer be available to establish the liability of insurers. If financial responsibility is questionable, the passage of time will cause the case to suffer from deteriorating evidence and increasing complexity because of subsequent additional exposures. Furthermore, a statute of limitations that has run out may not allow a suit to be filed.[13]

Determining financial responsibility is complicated still further when the worker has been exposed to hazards at several different work sites, which becomes more and more likely with the passage of time. The problem compounds itself, since even if we were somehow able to pick out a single place of employment where the exposure took place,

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[13] See, for example, the papers of Danzon (1984) and Epstein (1984) for a discussion of these problems in more detail.

this exposure might have occurred over the course of several years. As such, there might have been several changes in corporate structure and many insurers may have provided liability coverage to the employer. The problem also exists as to how we should apportion financial responsibility among the several insurers. This allocation of financial responsibility is complicated by the intricate layering of primary and excess insurers and by the exhaustion of policy limits in specific years in jurisdictions that hold that liability is joint and several. Much of the current turmoil in asbestos-related disease, for example, involves interpreting the language in insurance contracts written many years earlier.

V. Effective Deterrence

Incentives for Optimal Safety

Any system of compensation for occupational diseases affects employer behavior. Much of the literature in law and economics that addresses the question of liability for occupational diseases emphasizes the incentives the system provides for achieving an efficient level of safety in the workplace.[14] Ideally, the compensation system should provide incentives for employers to provide a safe work environment.

Penalizing firms on the basis of current standards provides a dubious incentive if the employer's actions were consistent with standards and norms at the time the exposure occurred. Epstein addresses

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[14] The concept of "efficiency" in this setting is discussed in part VII of the current paper.

this point, noting that, "(I)t is highly unwise to allow suits with the properties so common in modern tort litigation, in which a jury determines the standards for safe products while simultaneously determining whether a given product meets the standards just set."[15] The obvious problem here is that the standards are set around the circumstances involved in the claim which is being decided, so that an ex ante decision by the employer to comply (or not to comply) with this set of standards is impossible. A problem which may be even more serious is that this system of penalties provides a deterrent to the improvement of standards by employers who may face a large liability if they establish the likelihood that some practice or exposure creates a hazard in the workplace.

A related issue deals with the fact that technology is constantly changing, so that standards that existed at the time exposure to some occupational disease occurred will, most likely, be different from the standards of today. Our concern should be primarily with providing incentives to meet current standards and to improve those standards rather than focusing on what could have been done with knowledge that has developed since the exposure took place. Of course, the penalties for past violations signal employers as to how strict the system is in enforcing its standards. These signals help to deter unsatisfactory performance by employers subject to today's standards.[16]

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[15] Epstein (1984), p. 491.

[16] Viscusi (1984), p. 76, apparently overlooks this point in claiming that a penalty on past exposures "will not directly induce reductions in current risk levels..." Although, Viscusi is correct if no threat of penalty existed at the time of earlier noncompliance with standards of that time.

Incentives for Claims Filing

There is another side to the incentive issue, namely the incentives provided for the worker to file false or exaggerated claims. In some ways, the tort system and systems of insurance encourage these claims. Contingent fees, easy access to the courts and the near non-existence of counter charges for frivolous suits make it easy for claimants to seek excessive damage awards. Of course, the so-called "deep pockets" theory of jury decision making cannot be disregarded here, where jury awards are often partially based on ability to compensate. The current system provide an incentive to file late in the course of the disease (subject to statute of limitation constraints) since this strategy maximizes both the award size if the case is won and the probability of winning. This might be particularly problematic for diseases viewed as incurable. This late filing could delay the development of cures, rehabilitation and methods of limiting the further development of the disease.

We also have the usual types of moral hazard issues that arise in cases of asymmetric information. A fully covered worker might not take the proper on-the-job precautions, knowing that losses will be compensated. In addition, there is a moral hazard involved in determining the facts leading to the onset of the disease. For example, would the workman who had just been inadvertently exposed to a mild dose of radiation on the job find it in his interest to mention to his employer that he had been with his girlfriend, who is a nurse, the night before at a secret rendezvous at the hospital and that they

secretly met in the X-ray room with the equipment accidently turned on?

Of course, there might exist disincentives for filing claims (especially claims that are not too large) if the procedures involved are expensive, time consuming, tedious or embarrassing. A workman rendered impotent by a work-related exposure might be reluctant to seek recourse if it involves explaining to a jury or review panel (perhaps over and over again) the details of his impairment as well as defending the countercharge that he is only experiencing personal, psychological, sexual problems, and facing the possibility that disclosure of the condition might affect the quality of his life.

The Role of Information and Insurance

The asymmetry of information creates several problems. On the one hand, we have the moral hazard problem, where the workers have incentives to file claims that would not be justified based on full information. But the employer also is in a position to know and withhold information. The employee probably knows only as much information as available statistics show and the employer is willing to disclose as public information. If an employer can reduce future claims by being "unaware" of certain workplace hazards, it can choose to ignore information concerning these hazards so that it can later claim it was unaware of them.

The fact that both the employer and the employee may have insurance complicates matters. The employer's insurance may provide incentives for moral hazard by the employer. For example, regulations or legal

precedents which raise standards of due care and make it easier to prove employers did not exercise due care can have the effect of actually lowering the level of care used and causing a substitution of increased insurance purchases... hardly the intended effect.[17]

Additionally, the nature of the exposure to hazards which caused the disease for a particular individual is often uncertain. Questions arise as to which parties should be held financially responsible. The employer's behavior ex post of the discovery of a disease might, at least in part, be directed towards establishing insurer liability. At the same time, insurers will make an effort to show that they are not liable. Thus, some resources are directed towards establishing this potential liability of insurers--resources which could be used more productively elsewhere.

VI. Appropriate Compensation

Disparity Among Compensations

Unless compensation is decided on a case-by-case basis by an entity with complete information and ultimate wisdom, we are bound to have some individuals with similar claims compensated differently. Asymmetric information precludes complete knowledge so we cannot expect to compensate all individuals optimally (assuming we know what "optimal" compensation is). Although this might be minimized if the system induces all parties involved to truthfully reveal their private information, it cannot be guaranteed that providing such incentives is

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[17] See Schlesinger (1983).

consistent with basic efficiency conditions.[18] As a result, one individual might receive a million dollar award while a similarly situated co-worker, whose case is heard by a different jury or review panel, might have the case dismissed due to insufficient evidence.

The existence of potential disparity may encourage behavior which is aimed at affecting the compensation system itself rather than towards more productive uses. For example, a diseased worker may prefer to forego the optimal level of therapy prior to a hearing in order to gain sympathy for his or her current state of being. The asymmetry of information and the adversarial system of review (especially if it is the courts) provides incentives to all parties to overstate their respective cases.

Taken to the extreme, the system can suffer in general from two basic types of errors: (1) compensating undeserving victims (undeserving from a standpoint of causation) and (2) not compensating deserving victims. Obviously both types of errors are bound to occur. Moreover, the above description over-simplifies the situation, which in reality is continuous. Thus, we should talk about over- and under-compensating various victims, under- and overcharging various potentially responsible parties, and the degree to which they are incorrectly compensated or incorrectly assessed for injury.

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[18] A mechanism is said to be incentive compatible if telling the truth is a Nash equilibrium (i.e., if all economic agents find their optimal strategy is telling the truth rather than not telling the truth). If the mechanism is also to be individually rational, meaning all economic agents would choose to participate, it cannot guarantee a Pareto-efficient outcome. See Hurwicz (1973).

Even if we reduce some of the discrepancies by going to scheduled awards, as suggested by Danzon (1984), we retain the asymmetry of information and cannot guarantee that using the schedule will eliminate disparity, especially since schedules are finite whereas the set of possible outcomes forms a continuum. It may also be true that outcomes very near to each other in this continuum are placed quite far apart on our discrete compensation schedules.[19]

We also have discrepancies which are created by time and space. For example, Workers' Compensation lump-sum benefits for certain mishaps exhibit large differences among the various jurisdictions. In 1981, the loss of an arm at the shoulder brought a lump-sum award of $10,100 in North Dakota, whereas the same injury brought an award of $142,347 in the District of Columbia and an award of $225,507 to someone who was a federal employee. Workers' Compensation benefits for other scheduled injuries and permanent total disability show similar differences among jurisdictions. The point is that even the use of scheduled awards does not eliminate the variance inherent in the system.

No Compensation and Multiple Compensation

Even if the level of compensation could be determined with perfect information, a financial-responsibility system might be limited by

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[19] For example, the precise location of the amputation of a body limb might need to be classified as to one of several specific locations, each with quite different scheduled awards. We also might ignore such disparities which arise from life patterns that develop years after initial exposure. Consider here the former handler of radioactive wastes who later becomes the classical pianist, only to find his hands have developed cancerous growths due to his use of defective gloves.

bankruptcy considerations. Landes and Posner (1984), for example, show how bankruptcy constraints alter the incentives of employers to provide a safe workplace. Viscusi (1984) points out how a bankrupt firm also leaves its former workers who later develop disease conditions with no former employer left to sue. More generally, the effectiveness of any mechanism that depends upon ex post compensation from a previous employer needs to consider the employer's ability to pay when required. One needs to realize that such an employer may no longer exist, either because of an earlier bankruptcy or due to a myriad of other possible reasons, or if it does exist might not own sufficient resources to pay all claims.[20]

If a former employer is the only source of compensation, we have just discussed how it is possible that no compensation might be forthcoming. However, there are quite often multiple sources of compensation. Some of these may be via public welfare programs, some via insurance policies, some via torts awards, and still others via implicit contracts such as premiums for risk that might be built into the wage structure.

Public welfare programs usually provide assistance to the diseased individual without regards to the cause.[21] For example, public medical assistance and/or assistance from private foundations directed towards particular diseases might provide medical and therapeutic care

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[20] Another possibility is that a former employer has merged with or been acquired by another firm, in which case questions of liability for the new firm arise. This issue is not considered in our paper.

[21] However, some of the programs depend on the worker's wealth status and some programs are geared towards specific diseases.

and advice for no or nominal charges. Social Security Disability Insurance (SSDI), Medicare and Medicaid, for example, do not concern themselves with fault in allocating benefits. In addition to this public assistance, many employers provide private medical and/or disability insurance coverages to their employees. Furthermore, employees may opt to purchase additional insurance cover on a private basis. Some workers might also have disability provisions within their private pension plans. Additionally, some workers may have coverage through accidental death and dismemberment insurance (ADD), which provides lump-sum scheduled benefits, or through dismemberment provisions in their life insurance policies.

These benefits, along with those that are (at least in theory) related to the cause of the disease, such as Workers' Compensation insurance and tort awards, interact with each other in various ways. For example, successful tort actions enable the employer to recover (through various legal mechanisms) any Workers' Compensation payments. However, SSDI benefits are not recoverable in this way; and ADD benefits are paid regardless of other compensation. Thus, it is possible for injured workers to receive non-offsetting awards from different sources. The total of all awards might leave the individual financially better off following the disease than had the disease not occurred. This possible overcompensation will be exacerbated if the predisease wage level already included a premium for bearing job-related risks. Thus, the worker might end up being compensated both ex ante (through this risk premium) as well as ex post.[22]

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[22] See Viscusi (1983).

VII. Issues in the Design of Efficient Compensation

Basic Considerations of Efficiency

In theory, we desire a compensation system for occupational disease that equates the marginal benefits and marginal costs of the induced level of safety in the workplace. The usual problems associated with measuring costs and benefits apply in the area of occupational disease--perhaps to an even greater extent than usual. We are also confronted with problems associated with asymmetric information as discussed previously. Even if we could somehow circumvent these informational and measurement problems, we are still at an impasse in defining a collective set of value judgements for society, as is clear from the well-known results of Arrow (1951).

Given the above types of limitations, a more workable criterion is that developed by Danzon. She defines efficiency as the "minimization of costs from four sources: injuries, injury prevention, risk bearing, and the overhead cost of litigation and administration."[23] We suggest that another source of costs, namely inappropriate compensation, be added to those above. These costs are incurred whenever the compensation paid is different from the loss incurred. The inclusion of these costs is essential if we are to decide the level of protection against insolvency that is needed or to include in our analysis the costs of litigation and administration.

The costs of "injuries and injury prevention"--better referred to as "diseases and disease prevention" in our model--are straightforward

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[23] Danzon (1984), p. 518.

from a conceptual point of view, although it might be difficult in any specific case to measure these costs. The tradeoffs between disease costs and disease prevention costs is the focal point of incentives designed to provide an appropriate level of workplace safety.

We consider the cost of risk bearing to be the costs of uncertainty that are irreducible within the system of employers, employees and insurers. Ideally, it could be measured as the irreducible disutility associated with the uncertainty. Since aggregate wealth within the system is lower in states of the world in which diseases occur, we cannot fully insure all agents within the system as pointed out by Hirschleifer and Riley (1979). We view this as the cost of risk bearing. Quite apart from these risk-bearing costs, the cost of inappropriate compensation is viewed as the cost of misallocating contingent claims within the system. For example, if a risk-averse worker could be made just as well off (i.e., kept at the same level of expected utility) with a set of contingent claims that provided a lower expected wealth, the original set of claims can be viewed as too expensive and consequently inefficient.[24]

Assigning Liability

Even with complete information, we cannot circumvent the many problems associated with the compensating of occupational disease victims, although better information would at least help to lessen some

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[24]This argument implicitly assumes that some economic agent, e.g., the insurer, is risk neutral. Thus, the difference in expected wealth could be transferred to the risk-neutral agent to achieve a Pareto improvement.

of these problems. For example, if the source of exposure to occupational disease is clearly identifiable, perfect information about the probability of occurrence could be used to calculate compensating wage-risk premiums which in turn could be used to purchase insurance against untoward effects of the disease. If the sources of exposure are multiple, we can still assign a pro-rated liability with perfect information if the probability of occurrence is additive in the probabilities attributed to the potential sources. If the probability is not additive, the assignment of liability and/or financial responsibility among the various potential exposure sources is not so clear-cut. For example, if asbestos increases the risk of cancer five-fold and tobacco increases it ten-fold, but tobacco and asbestos taken together increase the risk of cancer one hundred-fold, how should we pro rate the liability? Or, if three years of exposure to a particular workplace condition is considered perfectly safe, but 15 years is considered extraordinarily dangerous, how should we assign liability for a diseased worker who has worked three years for each of five employers? Thus, we see that risk might be nonadditive across sources of exposure as well as nonadditive over time.

Epstein (1984) suggests that we assign liability in the second case to the last employer of the individual. Clearly this suggestion is aimed at reducing some of the costs of litigation and administration. If being the "last" in a chain of employers is random, there would not be any unfair long-run biases against a particular employer. In a sense, this is a risk-pooling scheme designed to minimize transaction costs. Unfortunately, such a scheme has adverse effects on

various markets. For example, workers with a history of exposure would not be hired by new employers who would rather hire inexperienced workers with no history of exposure. The lower skill levels of such inexperienced workers affects productive efficiency as well as affecting labor mobility.

If we wish to apportion the liability for occupational disease, the nonadditivity of effects from multiple sources is problematic. If we can determine the marginal risk introduced by a particular work environment, this would be the appropriate value to use in assigning a pro-rated liability. However, such a marginal contribution depends upon the risks already present and is thus sensitive to the order in which we "add up" the total risk. This marginal addition to risk is sensitive to personal characteristics of the worker as well as sensitive to the timing of its addition. We would not expect resulting wage risk premiums to be paid according to each individual worker's personal characteristics, but rather to set an efficient wage risk premium within the market and allow workers to self-select their place of employment. Only workers whose personal marginal valuation of additional job-related risk was below the market-based wage risk premium would accept employment. If a particular exposure becomes more dangerous with a longer exposure, for example, we would expect some workers to change jobs as their marginal risk valuation surpasses the wage risk premium over time.

If information concerning the marginal probabilities of contracting the disease from a particular exposure is used to create specific wage risk premiums, the proper incentives for workplace safety will be

instilled as is shown by Landes and Posner (1984). Landes and Posner suggest that we compensate workers who are exposed to hazards by paying them ex ante for the expected value of their future losses, which is essentially the same as paying a wage risk premium. The risk premium is based on the additional risks faced at a particular workplace. Of course, workers who never contract the disease will be compensated anyway and workers who do contract the disease from the workplace exposure are not paid full damages. There are also workers who will develop the disease from sources not contained in the workplace. However, we cannot know for certain which workers would have developed the disease without the workplace exposure; and our ex ante liability rule based on marginal probability changes can be shown to be ex post efficient to the extent that probabilities are correctly estimated.[25]

VIII. Concluding Remarks

Unfortunately, there is no criteria of optimality that can be generally applied when evaluating financial responsibility for occupational disease. Pareto efficiency cannot be expected and alternative models must be considered within a second-best framework. Our evaluation criteria, which are an extension of Danzon's, consider the social costs arising from five sources: injuries, injury prevention, risk bearing, overhead costs of litigation and administration, and inappropriate compensation. The incentives provided within any compensatory system play a major role in achieving (or at least striving towards) a minimization of these costs.

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[25] See Landes and Posner (1984).

Asymmetry of information is of key consequence in facilitating effective compensation schemes. Incentives to reveal privately held information on the part of both employers and employees are, unfortunately, lacking. Employer-specific information concerning the particulars of workplace hazards and employee-specific information regarding exposure to contributing factors outside the workplace could be used in conjunction with each other to develop defenses against the occurrence of occupational disease. Both parties might be better off if they were to reveal their private information. However, each has an incentive to conceal private information, regardless of the other's revelation strategy, thus creating a "prisoner's-dilemma" type of situation.

If wage differentials exist to the extent that workers in riskier occupations receive a higher wage to compensate for the extra risk, these differentials could provide a perfect ex ante compensation (if information about the risk is available). If workers are further compensated after the extra risk manifests itself via the onset of an occupational disease, we would apparently have a "double dipping" into the employer's pockets by the diseased worker. An alternative view is that ex post compensation is less than complete. In this view, wage differentials compensate workers ex ante only for the difference between what they would receive with complete ex post compensation and what they can actually expect to receive ex post. If workers expect a more complete ex post compensation for occupational disease, they will require a lower compensating wage differential for a given level of risk.

A compensation mechanism for occupational disease must work well within the bounds placed upon it by imperfect information and limited resources. This paper considers the design of such a mechanisms, paying particular attention to satisfying both ex ante and ex post criterions of efficiency. Compensation systems that are ex ante efficient--thus providing proper incentives for all economic agents to take efficient actions--cannot be deemed totally satisfactory when the system has the possibility of bankrupting itself or when ex post compensations are not correlated with damages incurred. Thus, ex post considerations must also be examined. We defined these ex post criteria and showed how much of the existing literature has not attempted to address these issues. We see no easy answers to some of the hard issues remaining; but at least we have a framework established that allows us to strive towards establishing an effective system of compensation.

REFERENCES

Arrow, K. J. (1951), Social Choice and Individual Values, New York: Wiley.

Arrow, K. J. (1971), Essays in the Theory of Risk Bearing, Chicago: Markham.

Barth, P. S. (1984), "A Proposal for Dealing with the Compensation of Occupational Disease," Journal of Legal Studies, 13, 569-86.

Beclacke, M. (1976), "Asbestos Related Diseases of the Lung and Other Organs," American Review of Respiratory Diseases, 187.

Burns, W. and D. W. Robinson (1970), Hearing and Noise in Industry, London: Her Majesty's Stationery Office.

Danzon, P. M. (1984), "Tort Reform and the Role of Government in Private Insurance Markets," Journal of Legal Studies, 13, 517-549.

Epstein, R. A. (1984), "The Legal and Insurance Dynamics of Mass Tort Litigation," Journal of Legal Studies, 13, 475-506.

Hirshleifer, J. and J. Riley (1979), "The Analytics of Uncertainty and Information: An Expository Survey," Journal of Economic Literature, 17, 1375-1421.

Hurwicz, L. (1973), "The Design of Mechanisms for Resource Allocation," American Economic Review, 68, 1-30.

Kakalik, J. S., P. A. Ebener, W. L. F. Felstiner, and M. G. Shanley (1983), The Cost of Asbestos Litigation , Institute for Civil Justice, Rand Corporation, Santa Monica, CA.

Landes, W. M. and R. A. Posner (1984), "Tort Law as a Regulatory Regime for Catastrophic Injuries," Journal of Legal Studies, 13, 417-434.

MacAvoy, P., J. Karr and P. Wilson (1982), "The Economic Consequences of Asbestos-Related Diseases," unpublished manuscript.

Oi, W. (1973), "The Economics of Producer Safety," Bell Journal of Economics, 4, 3-28.

Rubinfeld, D. L. (1984), "On Determining the Optimal Magnitude and Length of Liability in Torts," Journal of Legal Studies, 13, 551-563.

Schlesinger, H. (1983), "A Theoretical Model of Medical Malpractice and the Quality of Care," Journal of Economics and Business, 35, 83-94.

Tobias, A. (1982), The Invisible Bankers, New York: Washington Square Press.

Viscusi, W. K. (1983), Risk By Choice: Regulating Health and Safety in the Workplace, Cambridge: Harvard University Press.

Viscusi, W. K. (1984), "Structuring an Effective Occupational Disease Policy: Victim Compensation and Risk Regulation," Yale Journal on Regulation, 2, 53-81.

Williams, C. A. and R. M. Heins (1985), Risk Management and Insurance (5th edition), New York: McGraw Hill.